DOCUMENT RESUME

ED 421 072 HE 031 417

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TITLE Effects of Education and Team Projects on Student Attitudes toward Team Work.
PUB DATE 1998-00-00
NOTE 10p.
PUB TYPE Reports - Research (143)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Attitude Change; College Students; *Cooperative Learning; Group Dynamics; Higher Education; Instructional Effectiveness; *Student Attitudes; *Teamwork
IDENTIFIERS *California Polytechnic State University

ABSTRACT

This study compared the effects of team projects alone with team projects coupled with team-work education on college students' attitudes toward team work. The study modified a 30-item survey originally developed to study team work in professional research and development teams. The survey was administered to 250 students at the beginning and end of eight classes at California Polytechnic State University. In four classes (one psychology and three engineering classes) students worked together on a team project as part of their class grade. In the other four classes (three psychology and one business class), the students worked on a team project and also attended multiple lectures and participated in class activities that involved team work and group dynamics. The study found that: (1) the team projects improved students' overall attitudes about team work; (2) the positive impacts of working on team projects were more powerful when students also had class instruction about teams and group dynamics; and (3) the experience of working on teams did not impact beliefs about the serious problems which students had making their teams function well. These problems concerned finding time to meet with team members and each team member doing his/her fair share. (Contains 18 references.) (DB)

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ED 421 072

Effects of Education and Team Projects on Student Attitudes toward Team Work

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Introduction

As business organizations shift to a reliance on using teams, they require better team work skills and positive attitudes about team work from their employees. The pressure on professionals to perform their tasks with fewer employees, at faster speeds, and with more quality and customer responsiveness creates the need for team work in professional environments (Katzenbach & Smith, 1993). This is especially true for technical employees. The introduction of concurrent engineering has added to the importance of team work in the industry (Erlenspiel, Giapoulis, & Bunther, 1997). Technical projects are increasingly complex and require the use of teams; while technical employees are stereotyped as lacking team work and communication skills.

Businesses are expecting that college students will learn the skills necessary to work in teams (Braham, 1992). In addition, businesses are looking to colleges to produce college graduates with new skills, including learning to learn, communication, personal management, adaptability, group effectiveness, and interpersonal influence (Fellers, 1996). Team work has not yet been fully incorporated into the education system (Erlenspiel, Giapoulis, & Bunther, 1997). This is one of the reasons why NASA recently funded research on educating engineers to work in teams at undergraduate universities (Cummings & Freeman, 1996; Nowaczyk & Levi, 1996).

How should universities prepare students for team work? One approach is to create classes which teach group dynamics and team work skills. An alternative is to use cooperative learning approaches which emphasize team projects. This study examines the effects of the use of team projects and team work education on students' attitudes toward team work. It uses an approach developed to study professional engineering teams to examine the effects of educational approaches on university students.

* Parts of this research project were funded by the NASA Multidisciplinary Design and Analysis Fellowship Program.

Educating for Team Work

There are two major approaches used to teach team work skills in colleges. These approaches come from different disciplines. Cooperative education approaches evolved from public education; while group dynamics comes from psychology and organizational development.

The cooperative education approach was developed to counter the negative effects of competition on children's learning (Johnson, Johnson & Smith, 1991). Although competition is often viewed as a motivator, research on education shows that it often has a negative effect on learning for most students. Competition in the classroom is encouraged by individual task assignments and competitive evaluation and grading. Cooperative education deals with these problems by shifting to group projects and evaluation systems which are not competitive. This educational approach prepares students to work with others, emphasizes active or experiential learning, and encourages lifelong learning (Fellers 1996). One of the implications of this approach is that students can learn to work successfully in teams if the type of project and evaluation system supports this learning. However, not all studies have found a positive relationship between academic performance and cooperative learning groups (Kunkel & Shafer, 1997).

The study of group dynamics has focused on understanding how groups operate. This knowledge of groups has been used to develop information about how to improve the operation of groups and teams. Early in its development, the group dynamics approach adopted experiential learning as a mechanism for teaching people about groups (Johnson & Johnson, 1997). Through the use of lectures combined with classroom exercises, students are taught the principles of groups dynamics and get to experience how these principles work. As a marked distinction from the cooperative learning approach, the implication of the group dynamics approach is that learning team work skills requires the active learning of the principles of team work. Simply working on group projects is not sufficient to teach team work skills.

Development of a Model of Team Work

Attitudes about team work experiences are one way to measure whether a team work education program was successful and to identified areas for improvement in the program. This approach attempts to understand how people view the success of their teams and the reasons for the team's success or failure. An analysis of the characteristics of professional teams was used to develop a method to measure attitudes toward team work. Once the measuring system was developed, it was then modified for use on student teams.

One of the prerequisites to studying team work is to define the meaning of team success. According to Hackman (1986), there are three primary definitions of team success which relate to the task, social relationships, and individual. Team success obviously relates to performance on a task - successful teams complete their task and meet the organization's task goals. When a

successful team performs its tasks, it should develop social relationships which make it better able to perform the next task assigned to it. This is the social relations, or group maintenance, aspect of team work (Sundstrom, DeMeuse, & Futrell, 1990). The third aspect of team success concerns the individual. Participating on the team should help to improve a member's professional skills and help their career in the organization (O'Dell, 1989).

There are a variety of factors which relate to the success of team work. Teams need to have clear direction and goals so that they can focus their efforts and evaluate their performance (Katzenbach & Smith, 1993). Commitment to the team requires that the organization develops rewards for successful team participation (O'Dell, 1989). Organizational rewards require a performance evaluation system which measures both team success and an individual's contribution to the team. Good leadership is needed to help manage the internal and external relations of the team, and orient the team toward its goals (Manz & Sims, 1987). The task of the team must be suited for team work. This means that the task should be complex, important, and challenging so that it requires the integrated effort of the teams (Safizadeh, 1991). Teams require a supportive organization environment which allows team members to make and implement their decisions (Manz, Keating & Donnellon, 1990). This is especially important for self-managing teams because they do not have a designated manager with organizational authority. Teams must also manage their internal relationships effectively - the team or its leader must manage internal problems related to the task and its members (Carr, 1991).

Levi and Slem (1995) used these ideas about team work were used to construct a survey which measured attitudes toward team work and the factors related to team work in organizations. The analysis of the survey, conducted with over 350 engineers and technical professionals, showed that the three approaches to measuring the success of teams (organizational effectiveness, social relations, and individual benefit) were highly related and could be considered a single success factor. Factor analysis showed that the survey measured six additional factors about team work. These factors related to the evaluation and rewards of teams, social relations within the team, organizational support for teams, the task characteristics of the team's projects, the degree to which the team was self-managing, and the quality of team leadership.

The results of this study on research and development teams showed that professionals have a generally positive view of team work. They believe it is an effective way to perform their jobs and that its use was increasing. These positive beliefs about team work were highly related to the tasks they were performing (which were viewed as both challenging and complex) and the amount of support the organization provides for teams. The largest team work problem for these professionals was with the evaluation and rewards of teams. Many professionals felt that their contribution to the team was not adequately evaluated and not included in the organization's reward system.

While students were also generally positive about the use of team work (Levi, Kocher, & Slem, 1994), students were less likely to view team work as an effective way to complete their task. They were also less likely to believe that their job was well suited for team work (task characteristics), that their organizations supported the use of team work, and that their team had good social relations. Students were more positive about the personal effects of teams. They had higher ratings of the evaluation and reward system, and were more likely to view working on a team project as having personal benefits.

Although there were some differences between students and professionals, there were more similarities and the relationships among the team work factors were almost identical. Even though students and professionals perform different types of tasks in different organizational contexts, the dynamics of team work are the same in both types of teams.

Method

The thirty item survey which had been used to study team work in professional, research and development teams (Levi & Slem, 1995) was modified to examine student attitudes toward team work. The modified survey also contained questions on the students' background and the importance of various problems students have with team projects.

The survey was administered at the beginning and end of eight classes at Cal Poly. All together, 250 students participated in the study. In four of the classes (one psychology and three engineering classes), students worked together on a team project which was a substantial part of their class grade. In the other four classes (three psychology and one business class), the students worked on a team project and received multiple lectures and class activities on team work and group dynamics.

The pre/post administration of the survey allowed for an examination of the effects of these two teaching approaches on student attitudes toward team work. A two way analysis of variance was used to examine the effects of taking the classes and the differences between the two types of classes.

The main part of the survey contained thirty attitude statements which were grouped into the following seven factors based on previous research: success of team work, evaluation and rewards, social relations, organizational support, task characteristics, self-management, and leadership. In addition, students rated the importance of five problems which had been previously identified as problems with student team projects.

Results

The results of the analysis of the effects of team work education are presented in Tables 1 and 2. Table 1 presents the statistics for the analyses of variance for the seven team work factors. The "Time" effect shows the difference between the pre and post measures of the factors. The "Interaction" effect shows the impact of type of education on the pre and post scores. (The "Teaching Method" effect is not important since it includes both the pre and post scores.) Table 2 presents the mean scores for the factors in the analyses. All of the factors have been converted to 5 point scales with a 1 showing disagreement and a 5 showing agreement with the factors.

For the factor measuring the success of teams, attitudes about the success of team work improved after taking the class ($F(1,451) = 8.21$, $p < .01$). In addition, a significant interaction effect indicated that the classes that included lectures and activities about group dynamics had even greater improvement in their beliefs about the success of team work ($F(1,451) = 6.60$, $p < .01$).

For four of the six team work factors, there were significant improvements in attitudes about team work due to participating in the class team projects. Improvements were also found in attitudes about evaluation and rewards ($F(1,449) = 35.63$, $p < .001$), social relations ($F(1,450) = 18.65$, $p < .001$), task characteristics ($F(1,455) = 10.68$, $p < .001$), and self-management ($F(1,438) = 6.94$, $p < .01$).

On three of the six factors, there were significant improvements due to the addition of lectures and activities on group dynamics. Improvements were found in attitudes about evaluation and rewards ($F(1,449) = 15.53$, $p < .001$), social relations ($F(1,450) = 22.23$, $p < .001$), and leadership ($F(1,446) = 9.48$, $p < .01$).

The team work factors were correlated with the measure of the success of teams. Task characteristics had the strongest correlation with success ($r = .65$, $p < .001$), while most of the other factors also had strong and significant correlations (with r ranging from .40 to .50, $p < .01$). The exception to this was the self-management factor which was not significantly correlated with the success of teams.

Table 1

Analysis of Variance of Team Work Factor Scores

		df	F - test	p value
Success of Teams				
	Time	1	8.21	.01
	Teaching Method	1	10.30	.01
	Interaction	1	6.60	.01
	Error	451		
Evaluation and Reward				
	Time	1	35.65	.001
	Teaching Method	1	17.86	.001
	Interaction	1	15.53	.001
	Error	449		
Social Relations				
	Time	1	18.65	.001
	Teaching Method	1	.01	ns
	Interaction	1	22.23	.001
	Error	450		
Organizational Support				
	Time	1	4.20	ns
	Teaching Method	1	3.64	ns
	Interaction	1	.19	ns
	Error	249		
Task Characteristics				
	Time	1	10.68	.001
	Teaching Method	1	28.58	.001
	Interaction	1	4.72	ns
	Error	455		
Self Management				
	Time	1	6.94	.01
	Teaching Method	1	.01	ns
	Interaction	1	2.45	ns
	Error	438		
Leadership				
	Time	1	4.61	ns
	Teaching Method	1	6.28	ns
	Interaction	1	9.48	.01
	Error	446		

Table 2

Means of Team Work Factor Scores

	PROJECT ONLY		PROJECT & EDUCATION	
	Before	After	Before	After
Success of Teams	3.89	3.91	3.54	3.87
Evaluation and Reward	3.23	3.35	3.25	3.82
Social Relations	3.14	3.11	2.82	3.41
Organizational Support	3.66	3.74	3.53	3.66
Task Characteristics	3.95	4.02	3.48	3.82
Self Management	3.30	3.35	3.21	3.43
Leadership	3.41	3.36	3.38	3.70

In addition to the main survey, students were asked to rate the importance of various problems they encounter with student team work projects. The results to these ratings are presented in Table 3. Finding times to meet and not everyone doing their fair share were the most important problems, with over 75% of the students viewing these problems as very important. Having trouble making group decisions and personality conflicts among team members were also rated as very important by over 50% of the students. These problem ratings were not affected by the students' participation in the team projects or classes.

Table 3

Importance of Team Work Problems

	% Very Important
Finding times when all team members can meet	85%
Not everyone doing their fair share	77%
Having trouble making a group decision	57%
Personality conflicts among team members	50%
Poor skills of some of the team members	41%

Conclusions

There are three main conclusions from this study. First, having students do team projects in class did improve their overall attitudes about the success of team work and various aspects of team work. The main exceptions to this related to beliefs about the organization's support for teams and the quality of their team leaders which did not change.

Second, the positive impacts of working on team projects were more powerful when students had class instruction about teams and group dynamics. Class lectures and activities improved ratings on success, evaluation and rewards, social relations, and leadership.

Third, the experience of working on teams did not impact beliefs about the serious problems which students have making their teams function better. Regardless of their improved team work skills and attitudes, students believe that there are major problems which make team work difficult.

There are other issues which are important to note about these findings. In none of the classes were there significant negative effects from participating in team projects. Like previous studies on professional teams, one of the most important factors related to the perception of team success was the characteristics of the task. Motivating and challenging tasks help to create successful teams. Finally, although participating in a team project and learning about group dynamics changed many of the students' attitudes about team work, it did not change their attitudes about the organization. Students' views about how supportive the university and professors were of team work remained unchanged.

One troubling aspect of this research is the lack of change in student beliefs about the problems they have conducting team projects. Students had serious concerns about finding time to meet with their team members and each team member doing their fair share. One likely reason that attitudes did not change is that these problems may be beyond the reasonable control of the team. In many ways, these are problems which are controlled by the organization (or professor) rather than the student.

By their nature, team projects do require more time and create difficult scheduling problems for students. One implication of these findings is that professors who use team projects could significantly reduce team problems by providing an opportunity for students to use class time to coordinate and work on their projects. Even though lecture time is decreased, the group experience is an important part of the students' education.

Problems with each team member doing their fair share relate to the evaluation and reward system which the professor controls. When students have the ability to evaluate the performance of their team members as part of the class grade, the fair share problem is reduced. It is up to the

professor to develop and implement an evaluation system which helps students to manage this team problem.

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